Table 1: Studies examining aspects of technology for communication in the NICU

Authors, Year & Location	Study Purpose	Design, Sample Size & Demographics	Technology Used & Intervention	Main Study Findings	Limitations
Parent only					
Gray et al. 2000 Massachusetts, USA	To evaluate an internet-based telemedicine program designed to reduce the costs of care, to provide enhanced medical, informational, and emotional support to families of very low birth weight infants during and after their NICU stay	Design: Randomized, controlled clinical trial Sample size: Parents of N=56 very low birth weight infants (30 intervention, 26 control) Demographics: Control and intervention mothers' age approx. 31 years and infant gestational age approx. 27 weeks	Baby CareLink 6 online aspects: Message center, daily clinical report, video of infant, family room, clinical information, discharge preparation resources Access during NICU stay and for several months after discharge	Parents in intervention group reported fewer problems with duration of stay than controls (6.7% v 43.8%, p=0.04) or with visitation policy (13.3% v 50%, p=0.02). No significant differences between intervention and control parents on "continuity and transition," "family participation in care," "confidence and trust in clinicians," "family and infant support," "coordination of care," "family information and education"	Small sample size, cost of installation of equipment in parents' homes, did not evaluate cost of care
Lindberg et al. 2009a Luleå, Sweden	To describe the experiences of parents of preterm infants on the use of real-time videoconferencing between their home and the NICU	Design: Descriptive Sample size N=10 parent couples Demographics: Median mothers' age=33.5, median fathers' age=37.5	Real-time videoconferencing with parents after infant when home ("on leave" from NICU)	Themes: 1) Videoconferencing added to parents sense of security by having access to staff 2) Supportive face-to-face meetings 3) Need for control of use of videoconferencing	Small sample size, average and range of "on leave" time for sample was not provided, details about planned and

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					unplanned videoconferencing sessions was not provided
Piecuch et al. 1983 California, USA	To evaluate the effectiveness of a videophone made available to mothers whose infants were transferred to different institution	Design: Matched pairs (control, intervention) Sample Size: N= 14 mothers (n= 7 intervention; n = 7 control) Demographics: Mean age = 30 100% married 43% Filipino, 43% Latin,14% Black, <1% Caucasian	Videophone Mothers in intervention group could initiate call to infant's unit and video picture of infant was transmitted for as long as mother desired	Mothers in intervention group made significantly more calls to inquire about their infants than mothers in the control group during their hospitalization ($p < 0.03$) as well as after discharge ($p < 0.05$) Mothers expressed a sense of relief in seeing their infants, stating their imagined view was much worse than reality	Small sample size Content of calls to infant's unit or after discharge not measured Mother's "interest" in infant operationalized as "number of calls made"
Rhoads, Green, Gauss et al. 2015 Arkansas, USA	To describe the frequency and length of maternal and paternal viewing of their NICU infants via Web camera	Design: Descriptive Sample Size: N=219 mothers & 101 fathers, including 40 dyads included	Web camera focused on NICU infants	Mothers significantly more likely to log-on to Web camera than fathers ($p = 0.03$) though no significant difference in total minutes spent viewing ($p = 0.08$) or maximum minutes viewing in 1 session ($p = 0.69$)	No demographics provided Outlier data included which could bias results

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		Demographics: None provided			Length of stay not controlled for in analysis
Rhoads, Green, Mitchell & Lynch 2015 Arkansas, USA	To examine the relationship between web-camera viewing of hospitalized infants, parental stress, anxiety, and bonding scores at baseline (after second log in to web camera), 1- and 2-weeks post-enrollment	Design: Exploratory study with data collection at 3 time points Sample Size: N=42 parents (28 mothers; 14 fathers) in quantitative phase N= 13 parents in qualitative phase Demographics: 66% mothers, 33% fathers; 64% 20-29 years, 26% 30-39 years; 67% White, 24% African American; 33% high school education, 55% some college or college degree; 59% married	Web camera focused on NICU infants	No significant correlation between total stressor scores, and minutes spent viewing infant T1-T3. No significant correlation between anxiety scores and minutes spent viewing infant T1-T3. Significant, positive correlation between stress experienced due to baby's appearance and maximum number of minutes viewed in any one session T1 [r (42) = 0.31, p = .05], T2 [r (17) = 0.58, p = .01], and T3 [r (8) = 0.81, p = .02]. Significant correlation at T3 only between bonding scores and minutes spent viewing infant [r (8) = 0.84, p = .01]. While all parents preferred to be physically present, they were appreciative of the web camera.	High attrition at T2 (n=17) and T3 (n=8) limiting inferences Small sample size Dyadic data not included Mother-to-Infant Bonding Scale not validated for use in fathers

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				The majority of parents felt being able to view their baby reduced their stress and anxiety. All parents appreciated being able to have 24/7 access to viewing their infants	
Yeo et al. 2011 Singapore	To assess the feasibility and acceptability of an Internet-based telemedicine program and to evaluate its impact on infants' length of stay (LOS)	Design: Pre/post intervention Sample Size: N= 92 infants (n=46 intervention; n=46 control) Demographics: Mean age = 32.5 71% Chinese,16% Malay, 1% Indian, 12% "other"	Web camera focused on NICU infants Parents in intervention group able to view infant during 3 different 1.5 hour rest periods in a 24 hr. period	No significant difference in LOS between intervention and control group (*p*-value not provided) 100% of intervention parents found it useful for them and family members 92.1% of study parents had no concerns about privacy issues	Study not powered to examine differences in LOS Sample demographics limited to maternal age and ethnicity Intervention limited to mothers with internet access and knowledge of internet use
Parent and healthcare provider					
Epstein et al. 2015 Virginia, USA	To evaluate the feasibility of daily Skype or FaceTime updates with NICU parents and to	Design: Pre/post intervention Sample size: N=26 parents of 25 infants;	Skype or FaceTime daily for 5 days for routine updates	94% providers and 100% parents rated ease of updates as excellent or good. Over 90% of providers and parents	Small sample size, content of updates not fully described,

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	assess the intervention's potential for improving parent-provider relationships	nurses and physicians caring for study infants <u>Demographics:</u> Mean gestational age=31 (SD 4) weeks; Mean age on day of enrollment=24 (SD 25) days; Parents: 80% mothers, 80% white, 12% African American, 8% other		believed Skype and FaceTime to be reliable for NICU updates Parents' Understanding survey pre- and post-intervention: Overall not significant; subscores for parents' impressions of information sharing, NICU care, relationships with their infant's doctors and nurses, satisfaction with care both overall (M_{pre}=63.2 (SD 5.8), M_{post}=69.1 (SD 5.7), p=0.001) and within the last week (M_{pre}=27.6 (SD 2.8), M_{post}=29.5 (SD 3.2), p=0.04) were significantly improved after the intervention. Unique experiences during intervention were positive.	method for tracking updates was not inaccurate
Gund et al. 2013 Gothenburg, Sweden	To investigate whether the use of videoconferencing or a web application improves parents'	<u>Design:</u> Randomized, controlled trial <u>Sample size:</u> N=6 nurses, N=34 families (n=13 standard care,	Standard care plus either Web application (Care@ Distance) or Skype videoconference	<u>Web application</u>: 83% families found application to be excellent or good, 50% families reported more confidence in caring for child at home, 67% felt	

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	satisfaction in taking care of a premature infant at home and decreases the need of home visits. In addition, nurses' attitudes regarding the use of these tools were examined.	n=12 web application, n=9 Skype) <u>Demographics:</u> Mothers' mean age=31 years; median gestational age=33 weeks	Interviews with parents several months after discharge	web application did not reduce need for home visits <u>Skype:</u> 100% families were satisfied with Skype calls, 100% reported feeling more confident in caring for child at home, 25% felt Skype calls did not reduce need for home visits Nurse attitudes: 4 of 5 nurses felt it was easy to send messages via web application, 4 of 5 sent messages weekly or less, only 2 of 6 nurses used Skype during the study period	
Globus et al. 2016 Tel-Hashomer, Israel	To evaluate the impact of using short message service (SMS) technology for updating parents of preterm infants with medical information on	<u>Design:</u> Pre/post-implementation <u>Sample size:</u> N= 91 parents, 27 nurses (pre-SMS implementation)	Infant clinical data downloaded automatically from the medical record and sent to infants' parents at 9 each morning. Data include bed location, current	<u>Parents' perceptions</u> of communication, satisfaction, anxiety Post-SMS scores higher for some aspects of communication (e.g., "I felt comfortable approaching the physicians" M_{pre} 4.3 (SD	Ceiling effect for survey. Parents self-selected for participation, measure of minutes on telephone was estimated by nurses not

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	parents and nursing staff	N=87 parents, 35 nurses (post-SMS implementation) Demographics: Mean mothers' age pre-30.7 years, post-32.2 years; mean fathers' age pre-31.7 years, post-34.2 years, >90% married (both groups), gestational age <32 weeks pre-43.6%, post-40.2%	weight, tests performed	1.0) M_{post} 4.7 (SD 0.6) p=0.001) No differences in anxiety or overall satisfaction Nurses' perceptions: No differences in time spent on telephone with parents. Pre-SMS, 75.9% believed intervention would increase workload, post-SMS 51.4% estimated that it would. Pre-SMS, 40.7% anticipated that SMS would not be user friendly. Post-SMS 17.6% believed not user friendly.	measured objectively
Healthcare provider only					
Joshi et al. 2016 Wisconsin, USA	To explore the perceptions of nurses and their workflow and identify determinants that may disrupt or facilitate the use of a commercially available camera service.	Design: Descriptive Sample size: N= 42 nurses 753 completed surveys (1 survey per infant per shift, including 623 "on camera" and 130 "off camera")	NICVIEW webcam system Infants "on camera" had NICVIEW available. Infants "off camera" did not.	15.4% of nurses caring for infants "on camera" reported spending 60 minutes or more interacting with families compared with 8.5% of nurses caring for infants "off camera." 72.9% of nurses believed that having the camera	Small sample size, self-reported minutes of engagement with parents and camera adjustments, tables mislabeled and

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		Demographics: Median years in NICU=15; 82% worked 32-40 hours per week		service for parents is useful.	data not clearly described.
Lindberg et al. 2009b Luleå, Sweden	To describe the experience of certified pediatric nurses with the use of videoconferencing between the NICU and families' home	Design: Descriptive Sample size: N= 10 nurses Demographics: All female, median age 49 years, median years working in neonatology=7.5	Real-time videoconferencing with parents after infant when home ("on leave" from NICU)	Themes: 1) Enabling meetings with the whole family 2) Facilitating assessment of the overall situation at home 3) Providing security to the family 4) Difficulties with continued use and development	Small sample size, selection bias, content of calls not fully described, details about planned and unplanned sessions not provided